TANKS AT THE IRON CURTAIN 1946–60

Early Cold War armor in Central Europe

STEVEN J. ZALOGA

ILLUSTRATED BY FELIPE RODRÍGUEZ

NEW VANGUARD 301

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INTRODUCTION

This book is the first of three to survey the tanks facing each other along the Iron Curtain from the end of World War II to the demise of the Soviet Union. This first volume deals with the tanks that remained in service from World War II, as well as the first generation of postwar tank designs. The following two volumes cover the next generation of tanks between 1960–1975, and the 1975–1990 generations. Due to the large number of armies in NATO and the Warsaw Pact, the focus is on the more consequential armies, including the main protagonists and the forward deployed allies. So, in the case of the Warsaw Pact, greater attention is paid to the "Northern Tier" of East Germany, Poland, and Czechoslovakia, and less to the "Southern Tier" of Hungary, Romania, and Bulgaria.

The immediate postwar period saw widespread demobilization of the wartime armies and a drastic reduction in tank production. Tensions in Europe between the Soviet Union and the Western Allies began to fester in the final year of the war, due to Stalin's plans to Sovietize the countries of east central Europe by force. In March 1946, Winston Churchill delivered his famous "Sinews of Peace" speech at Westminster College in Fulton, Missouri in which he remarked that "From Stettin in the Baltic to Trieste in the Adriatic, an iron curtain has descended across the Continent."

The first years of the Cold War saw little military expansion due to general war exhaustion in Europe. The Communist takeover of Czechoslovakia in February 1948 marked the end of political autonomy in the Soviet-occupied region. In response to the growing political tensions, in 1949 the North Atlantic Treaty Organization (NATO) was formed as a mutual defense agreement against further Soviet expansionism in Europe. The economies of the NATO countries were still suffering from the devastation of war, and so in October 1949, the US Congress authorized the Mutual Defense Assistance Program (MDAP) which allocated $1.4 billion to help rebuild Western European defenses. As a result, the NATO armies, except for Britain, were primarily equipped with American tanks during this period.

The Communist victory in China in 1949 and the Korean War in 1950 accelerated the Cold War arms race. In 1955, the Federal Republic of Germany was accepted into NATO and in November of that year, the Bundeswehr was created. The Soviet Union reciprocated in March 1955 by

creating a corresponding alliance network, the Warsaw Pact, and creating the National Volksarmee in East Germany.

Tank development during these fifteen years fell into three main periods. From 1945 to 1950, tank production stagnated as most countries recovered from World War II. There was widespread developmental work, but very low levels of tank manufacture. The Soviet Union and the USA built up their allies largely by the transfer of surplus World War II tanks. As the Cold War began to heat up in 1950, tank production again began to accelerate. This largely consisted of the first generation of postwar designs, mostly evolutions of late war designs. During 1955–1960, the armies of the Warsaw Pact and NATO began to adapt to the nuclear battlefield. This caused substantial doctrinal ferment as well as some technical changes to the tanks themselves. However, the larger impact was that most armies began to shift the balance in defense spending to missiles and tactical nuclear weapons, trimming back tank production from its peak around 1955.

THE TANKS, DOCTRINE, AND ORGANIZATION

Soviet Union

In May 1945, the Red Army deployed six tank armies, 24 tank corps, 14 mechanized corps, 64 separate tank brigades and numerous smaller armored formations. In February 1946, it was renamed as the Soviet Army (Sovetskaya Sukhoputnaya Voyska). There was a substantial demobilization after the war and the overall strength of the armed forces fell by about 8.5 million to 2.9 million personnel in 1948. After the war, wartime tank corps and mechanized corps were renamed as tank and mechanized divisions, in keeping with most other armies. During the reorganization of 1945–49, a total of 30 tank and 65 mechanized divisions were organized on the basis of the wartime formations. The large increase in the number of mechanized divisions was due to the conversion of rifle divisions. Only a portion of these divisions remained near full strength; most were reserve or cadre formations.

The postwar Soviet tank division was based around three tank regiments, a heavy tank/assault gun regiment (tankosamokhodniy polk), a motorized rifle regiment, and divisional artillery. The mechanized division reversed the balance of tanks and infantry and consisted of three mechanized regiments, a tank regiment, and a heavy tank/assault gun regiment. The tank regiment was equipped with three battalions of medium tanks (65 tanks) and a motorized rifle battalion. The heavy tank/assault gun regiment in a tank division typically had two battalions of heavy tanks (44 tanks) and a battalion of ISU-152 assault guns; the ratio of heavy tanks and assault gun battalions was reversed in the regiments in mechanized divisions.

No Soviet tank more worried NATO in the early 1950s than the IS-3 heavy tank. Its debut at the September 1945 victory parade in Berlin was a complete shock to Western observers, due to its advanced armor layout. A total of 52 IS-3 tanks took part in the parade, belonging to the 71st Guards Heavy Tank Regiment, 2nd Guards Tank Army.

In spite of their name, mechanized regiments in the late 1940s relied primarily on motor transport and not armored infantry vehicles.

At the end of 1947, the Soviet Army had 26,715 tanks on hand.

Soviet Army tank strength 1947	
T-34 (76mm gun)	2,000
T-34-85 and T-44 medium tanks	15,460
IS heavy tanks	2,780
KV heavy tanks	765
T-60/T-70 light tanks	2,110
Lend-Lease M3 light and M3 medium tanks	160
Lend-Lease M4A2 medium tanks	585
Other Lend-Lease tanks	305
War-booty German tanks	710
Obsolete pre-war tanks (inc. T-26 and BT)	1,840
Total	**26,715**

Postwar plans for the tank force were to relegate the miscellaneous and obsolete types to war reserve or the smelter. Many of the standard types were war-weary. At the war's end, the Main Armored and Tank Directorate of the Red Army (GBTU-KA) had an ambitious plan for postwar tank production. This was about two-thirds the peak wartime production level, but was quite fanciful in view of the economic devastation caused by the war. In the event, actual production in 1946–50 was only 6,210 tanks, a mere six percent of the original plan.

GBTU-KA Postwar tank production plan						
	1946	**1947**	**1948**	**1949**	**1950**	**Total**
Light tanks	200	2,400	3,000	3,600	4,200	13,400
Medium tanks	12,000	12,600	13,200	13,800	14,400	66,000
Heavy tanks	3,360	3,960	3,960	3,960	3,960	19,200
Total	**15,560**	**18,960**	**20,160**	**21,360**	**22,560**	**98,600**

The IS-2 remained in service well into the 1970s and some remained in war reserve until 1997. A modernization program was conducted in 1957–59, which replaced the engine, as well as incorporating many other improvements. The IS-2M can be distinguished from earlier versions by the hull stowage panniers, as seen on this example. This tank was retired to the Muzey Pobedy (Victory Museum) at Poklonnaya Gora in the early 1990s.

The first postwar Soviet medium tank was the T-44 which had a turret reminiscent of the T-34-85, but with an entirely new hull. This series had significant technical problems and underwent several phases of modernization. This is a T-44M from the 1966 upgrade, which had the new TPK-UB commander's sight, TVN-2 infrared night driver's sight, two-axis gun stabilization, and new external fuel cells. This particular tank is fitted with a STU dozer blade.

In the medium tank category, T-34-85 production continued until 1946, largely because it was the only reliable type in production. There had been plans to replace it with the T-44 starting in 1945, but this new design proved to be mechanically troublesome. More importantly, it was armed with the same 85mm gun as the T-34-85, but it was significantly more expensive. The preferred solution was the T-54, which was basically a T-44 with an enlarged turret and 100mm gun. Even after the first batch of T-54 tanks was completed, production was very slow due to lingering problems with the turret design and other technical issues. The T-54 did not become mature until 1951, limiting the scale of its manufacture.

Likewise, there were problems with heavy tank production. Although the IS-3 was NATO's dreaded bogeyman, it was a seriously flawed design, so it remained in production for only two years. It was followed by the IS-4, a completely different design by another engineering team. It was less troublesome than the IS-3, but it was extremely costly. Only enough were built to equip three regiments. Prior to the outbreak of the Korean War, most of these were sent to the Far East, and so they never appeared in the NATO/Warsaw Pact confrontation. The Soviet Army generally viewed heavy tanks as offering about 20–30 percent greater combat effectiveness over medium tanks, but at more than double the cost. Heavy tank production did not resume until 1953 when the IS-8 was accepted for service; its name was changed to the T-10 after Stalin's death in 1953.

The T-10 was a further evolution of the IS-3, but with a lengthened hull and the improved V12-5 engine. The original T-10 version, as seen here, was armed with the same 122mm D-25T gun as the IS-3. The cylinders on the hull rear are BDSh-5 smoke cannisters.

Soviet light tank production ended in 1943. The Soviet Army wanted a new amphibious light tank for this category, and a satisfactory

The T-54 Model 1947, also known as the T-54-1, used a turret with a broad mantlet. This version proved mechanically troublesome in service, leading to a string of redesigns through the early 1950s.

BELOW LEFT
The T-54 Model 1949, also known as the T-54-2, introduced a new turret with a narrow "pig-snout" gun mantlet. In comparison to later and more familiar versions of the series, the turret rear had a distinct overhang. This is an initial series production tank with the early narrow track and early external fuel cells.

BELOW RIGHT
A column of T-54B tanks. This vehicle has the characteristic Luna infrared night fighting system and the TPN-1 gunner's sight. The T-54 series can be distinguished from the later T-55 series by the mushroom cover over the turret ventilator in front of the loader's hatch.

design did not emerge until 1951 as the PT-76. The Soviet Army continued to consolidate after Stalin's death. In 1955, there were about 120 rifle divisions, 65 mechanized divisions, 30 tank divisions, and 14 airborne divisions; the last cavalry division was disbanded in April 1955.

In response to 1953 US Army tests of tactical nuclear weapons, on September 14, 1954, the Soviet Army conducted Operation *Snezhok* (*Snowball*) at the Totskoye proving ground. A 40 kiloton RDS-4 atomic bomb was dropped from a Tu-4 bomber on a target area to simulate the use of nuclear weapons to overcome an enemy defense line. Troops of the 12th Guards Mechanized Division and 50th Guards Rifle Division and supporting units subsequently advanced into the blast zone. The exercise involved about 600 tanks and assault guns and a similar number of armored personnel carriers.

These early experiments began the process of adapting Soviet doctrine to the future nuclear battlefield. The tests made it very evident that infantry needed to be mechanized both to shelter them on the nuclear battlefield as well as to provide sufficient mobility to reduce the vulnerability of a division to nuclear strikes. These changes were implemented in 1957 with the abolition of the rifle and mechanized divisions and their conversion into the new motor-rifle division (motostrelkovaya diviziya). These divisions were

mechanized by the addition of new armored personnel carriers, starting with the BTR-152 in 1950. By 1957, the Soviet Army was reconfigured into 47 tank, 180 motor-rifle, and 11 airborne divisions.

In 1957, the USSR had about 150 nuclear weapons, all of which were assigned to strategic missions. Development of small tactical nuclear warheads began in the early 1950s, and the small RDS-41 nuclear warhead was first tested in March 1956. In the late 1950s, the Soviet stockpile rose to about 1,700 weapons, including the first tactical weapons assigned to the army's artillery branch. The Soviet Army adopted two battlefield nuclear missiles in the late 1950s: the Luna at divisional level, and the R-11 at corps level.

Soviet nuclear capable tactical ballistic missile production

		1957	1958	1959	1960	Total
Luna/Luna-M (FROG)	missiles				365	**365**
	launchers				80	**80**
R-11/R-11M (Scud A)	missiles	134	190	390	314	**1,028**
	launchers	4	45	56	34	**139**
Total	**missiles**	**134**	**190**	**390**	**679**	**1,393**
	launchers	**4**	**45**	**56**	**114**	**219**

Adaptation to the nuclear battlefield continued for well over a decade. Aside from organizational and doctrinal changes, technical modifications to the equipment were required. Tanks offered a certain level of inherent blast protection, as long as the tank was sufficiently distant from the nuclear detonation. In the mid-1950s, this was presumed to be 1.5km from the point of detonation. However, the crew could still be debilitated from radioactive fall-out if dust was drawn into the tank by the ventilator. As a first step, an anti-atomic protection system (*PAZ: Protivoatomnoi zashchiti*) was developed for tanks in 1955. This consisted of sealings for the hatches, as well as a redesign of the ventilation system, which combined both air filtration as well as internal overpressure to limit dust intrusion into the crew compartment. This was one of the reasons for the development of the T-55 tank, which otherwise was only a minor evolution of the T-54 series. The PAZ system was finally ready in late 1958. More sophisticated technologies, such as anti-radiation linings, did not begin to be deployed until after 1960.

Another technological innovation that concerned the Soviet Army at this time was the guided antitank missile. Germany had been developing such weapons in 1945, but they did not enter service during the war. In the postwar

BELOW LEFT
The PT-76 in its 1954 configuration can be readily identified from the early slotted muzzle brake on its D-56T 76mm gun. The 1955 configuration introduced a more conventional muzzle brake on the improved D-56TM gun.

BELOW RIGHT
The PT-76B, which entered production in 1959, was a substantial redesign incorporating a heightened hull to provide better buoyancy when swimming. Aside from use by Soviet Ground Forces, the PT-76B was widely used by Soviet Naval Infantry units, as seen here during a winter training exercise.

The IS-3 heavy tank underwent a design correction program in 1948–52 to deal with initial design flaws. There was a second modernization effort in 1959 designated as the IS-3M. This included night vision for the driver, an improved engine, and new tracks. Some features of the T-10 series were incorporated including the reinforced wheels and side skirts, as seen here.

years, the French were pioneers in this field, with their SS.10 missile entering service in 1955. Stalin's successor, Nikita Khrushchev, took personal interest in missile development; his son worked in one of the main missile design bureaus. Khrushchev saw missiles as a panacea for Moscow's defense budget problems. Equipment programs associated with the nuclear battlefield had become extremely costly. The army was buying not only new tanks, but thousands of armored infantry vehicles. Tactical ballistic missile launchers were entering production along with expensive new air defense missiles to protect the army from NATO air attack.

At the most superficial level, missiles seemed to offer an economical alternative to more conventional weapons. In the case of the army, an antitank missile costing a thousand rubles could destroy a tank costing hundreds of thousands of rubles. Khrushchev was especially unhappy with the expensive heavy tanks, favoring missile-armed tank destroyers in their place. Further development of heavy tanks was formally halted by a Council of Ministers decree on July 19, 1960.

Soviet tank production 1945–1960*

	1945–50	51	52	53	54	55	56	57	58	59	60	
PT-76		10	85	210	402	498	206	285	180	150	105	**2131**
T-34-85	5742											**5742**
T-44	1253											**1253**
T-54	1772	1566	1854	2000	2276	2665	1835	1995	770	50		**16783**
T-55									610	1802	2267	**4679**
IS-3	1430											**1430**
IS-4	219	25										**244**
T-10				10	30	90	100	130	174	185	198	**917**
Total	**10,416**	**1601**	**1939**	**2220**	**2708**	**3253**	**2141**	**2410**	**1734**	**2187**	**2570**	**33179**

**Post-war production in Sep-Dec 1945.*

The improved T-10M introduced the M62-TS 122mm gun with its distinctive slotted muzzle brake. A 14.5mm KPVT heavy machine gun replaced the 12.7mm DShK machine gun on previous versions. A total of 1,079 T-10Ms were built from 1958 to 1965, along with 10 T-10MK command tanks. These examples from the GSFG tank training regiment are seen here on parade in Berlin.

Warsaw Pact

The Polish People's Army (*LWP: Ludowe Wojsko Polskie*) was the largest of the satellite armies. It fought alongside the Red Army in the final years of the war, including the Berlin and Prague campaigns, and eventually totaled 14 infantry divisions and one armored corps at the end of World War II. Its officer ranks were dominated by Russian and Ukrainian officers seconded from the Red Army. The LWP received 517 T-34 and IS-2 tanks during the war, of which 220 (62 T-34s, 132 T-34-85s, and 26 IS-2s) were still in service at the end of the war.

A T-55 tank in the initial 1958 configuration. This had a flush loader's hatch on the right side of the turret, lacking the 12.7mm heavy machine gun seen on the previous T-54 series. Careful inspection of the glacis plate shows the opening for the hull-mounted 7.62mm machine gun, deleted on the subsequent T-55A.

The 1st Czechoslovak Army was a symbolic political effort with very modest strength at the end of the war. It was raised and equipped by the Red Army, and after the war was reinforced by the 1st Czechoslovak Armoured Brigade that had been raised by the UK. In 1951, the Czechoslovak Army had about 655 tanks, including 82 T-40/75 (PzKpfw IV), 1 T42/75 (Panther), 368 T-34-85, 6 IS-2 heavy tanks, 22 Challengers, and 176 Cromwells.

The most problematic satellite armies were those of the erstwhile "Fascist" states allied to Germany, including Romania, Hungary, and Bulgaria. Romania and Bulgaria had switched sides in 1944 and fought alongside the Red Army. Hungary had remained in the German camp until the war's end in 1945. These armies were equipped with an uneven assortment of equipment, and their better equipment tended to be German. The Red Army handed over captured German tanks to both Romania and Bulgaria after the war. Bulgaria formed two tank brigades, which had 119 German tanks, including 102 PzKpfw IVs and 14 Panthers. Romania formed a tank division and motor-rifle division in 1949, which was equipped with a motley selection of German tanks and other equipment.

During production of the T-34-85 in Poland, a variety of upgrades were developed. An initial set of upgrades was adopted in the T-34-85M1, including an engine heater, new air filters, increased ammunition, improved radios, and reduction of the crew to four by fixing the hull machine gun in place. These upgrades were undertaken at the Wojskowe Zakłady Mechaniczne in Siemianowice Śląskie. This is a pair of Polish T-34-85M1 tanks during summer exercises in the mid-1960s, painted in experimental three-color camouflage.

ABOVE LEFT
The Czechoslovak tank industry made a number of major export sales in the mid-1950s by off-loading its old German vehicles to Syria and selling a significant number of its new T-34-85 tanks, including a major sale to Egypt. This Egyptian T-34-85 of Czechoslovak manufacture was lost in the Sinai in the 1956 war.

ABOVE RIGHT
A trio of Polish T-54A on exercise in the late 1950s. At this point, Polish tanks still retained the wartime white eagle national insignia, switching to the red and white national checkerboard insignia in 1965–66.

Moscow formed a shadow army in East Germany in 1949 under the guise of police units. These were consolidated as the *Kasernierte Volkspolizei* (KVP: Barracked People's Police) that included three tank formations with an initial strength of 19 T-34 tanks. The size of the KVP tank force increased through the early 1950s. The establishment of the Warsaw Pact in 1956 was accompanied by the conversion of the KVP into the NVA (*National Volksarmee*). At this time, the NVA had 682 tanks including 119 T-34s, 516 T-34-85s, and 47 IS-2s in 1 tank division and 3 motor-rifle divisions.

The Soviet Union began to impose a standardized pattern on the satellite armies from the late 1940s, prior to the formation of the Warsaw Pact. Since a significant number of tanks would be needed to re-equip the satellite armies to Soviet standards, Moscow eventually decided to have Poland and Czechoslovakia license-produce Soviet tanks, not only for their own armies, but for the other Pact countries. The initial 1951 program was for the production of the outdated T-34-85 tank.

Poland had no major arms industry, so it centered its tank production at a new factory, the Zakłady Mechaniczne Bumar-Labędy. The original plan was to manufacture 5,300 T-34-85s from 1952 to 1955, but this proved to be wildly ambitious, due to the difficulties of creating an entire new industry.

A

1. HUNGARIAN ARMY T-34-85, HUNGARIAN REVOLT, BUDAPEST, OCTOBER 1956
During the 1956 Hungarian revolution, a number of Hungarian Army units, including some tank units, went over to the rebel side. This is a Soviet-manufactured, Plant No. 183 production T-34-85. The rebels have painted over the usual Hungarian People's Army red star in favor of the traditional Hungarian coat of arms. The slogan on the turret around the coat of arms is: "Éljen a forradalom" (Long Live the Revolution). The slogan on the hull is "Ez a haza magyar haza, minden orosz menjen haza" (This home is a Hungarian home, all Russians go home).

2. T-34-85, TANK COMPANY, 5TH COASTAL DEFENSE BRIGADE, LĘBORK, POLAND, 1956
In 1951, the Polish Army created the 2nd, 3rd and 5th Anti-Landing Brigades (*Brygada Przeciwdesantowa*) for the defense of the Baltic coast, part of the later Anti-Landing Corps (*Korpus Przeciwdesantowy*). The 5th Anti-Landing Brigade was stationed in the Gdansk area. In the mid-1950s, the Soviet Army assigned these units more offensive tasks, such as amphibious missions in the Danish straits. As a result, they were reorganized in the summer of 1958 as the 3rd and 5th Coast Defense Brigades (*BOW: Brygadę Obrony Wybrzeża*). The new formations each had a tank company equipped with T-34-85 tanks. In the early 1960s, these units were incorporated into the 23rd Landing Division (*23 Dywizja Desantowa*), which eventually evolved into the famous "Blue Berets" of the 7th Lusatian Landing Division (*7 Łużycka Dywizja Desantowa*). In the 1950s, the tanks of these units carried the usual Polish white eagle national insignia, but added an anchor to the design, due to their mission.

1

ÉLGEN
A FORRADALOM
EZ A HÁZA MAGYAR HÁZA MINDEN OROSZ
MENJEN HÁZA

2

2731

In 1956–61, the *National Volksarmee* received 1,346 T-34-85s from the Soviet Union. There were many improvement programs through the 1960s, some of which are evident on these tanks, such as the rear turret stowage bin and the racks on the hull rear for stowing 200l fuel drums and BDSh smoke dispensers. The white markings on this tank identify opposing forces during summer wargames.

Czechoslovakia had been the arsenal of the old Austro-Hungarian Empire, including such world-famous firms as Škoda and ČKD. There were two tank plants in the Czech provinces at the end of the war, which were manufacturing the Jagdpanzer 38 (Hetzer) tank destroyer for the Wehrmacht. Production continued after the war, including exports to Switzerland, as well as prewar light tanks to various clients. In 1950, the army was planning to adopt a new Czechoslovak-designed medium tank, but this was squashed by Moscow's insistence on the license production of the T-34-85. Production was divided between the established ČKD plant in Sokolovo and the new ZJVS plant (Závod J.V.Stalina) in the Slovak town of Martin.

The early 1950s were a time of considerable turmoil in the satellite countries, due to resistance to heavy-handed Stalinist political repression. There were revolts in Berlin in 1953 and Budapest in 1956. Poland was on the verge of rebellion in 1956, but an internal coup in the Polish Communist Party won concessions from Moscow. This delayed the modernization of the satellite armies, because of Moscow's skepticism about their loyalties.

Following the creation of the Warsaw Pact and Khrushchev's rise to power, relations between Moscow and the satellite countries gradually relaxed. Poland and Czechoslovakia were unhappy with being saddled with the production of the obsolete T-34-85 tank, and in 1956 there was an agreement over the production of the more modern T-54A. This began at Martin in 1957, renamed ZŤS-Martin (Závody Ťažkého Strojárstva) after Stalin's death, and at Bumar-Labędy in 1958.

Warsaw Pact tank production

		1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	Total
T-34-85	PRL		5	310	370	430						**1,115**
T-34-85	ČSR	25	400	1,050	500	446	315					**2,736**
T-54A	PRL								109	214	220	**543**
T-54A	ČSR							10	98	313	350	**771**
Total		**25**	**405**	**1,360**	**870**	**876**	**315**	**10**	**207**	**527**	**570**	**5,165**

PRL: Polska Rzeczpospolita Ludowa; Polish People's Republic ČSR: Československá Republika; Czechoslovak Republic

USA

In May 1945, the US Army in the European Theater had about 11,100 tanks deployed with additional tanks in reserve. Counting tanks in the Mediterranean and Pacific as well as in the United States, the overall total was 28,776, as detailed in the accompanying table. The US Army began winding down tank production in late 1944 and canceling portions of some contracts. Manufacture of the M4 Sherman medium tank ended in July 1945. Wartime plans had called for 6,000 M26 Pershing tanks to be built, but production halted in October 1945 at 2,212 tanks.

The War Department Equipment Board headed by Gen. Joseph Stilwell issued its report in January 1946 that recommended that the army initiate a five-year program to develop new light, medium, and heavy tanks. Although tank prototypes were built to test new designs, there was no serial production of tanks in the United States again until 1950.

Major armored forces deployed overseas amounted to only three US Constabulary brigades, similar to a military police force, and a divisional tank battalion in occupied Germany and four tank companies attached to the occupation divisions in Japan. After reaching a low point in 1947, the worsening international situation with the Soviet Union encouraged Washington to halt the decline and to begin a gradual rebuilding of army strength. This eventually included the conversion of the three Constabulary brigades in Germany into armored cavalry regiments. On paper, each infantry division was supposed to have an organic tank battalion; but this had not been completed by 1950.

By 1948, the US Army's tank inventory had become so decrepit from lack of maintenance that only 1,762 tanks were considered fit for field use. In July 1948, the US Army initiated a program to rebuild all economically repairable tanks by the end of 1951, for future US use or for transfer to allied armies. In 1949, the army initiated a "Balanced Tank Program," which planned to cut the inventory by more than half by 1950, some of the tanks being transferred as foreign aid and others being converted to recovery vehicles. When tensions began rising in 1950, the US Army in Europe (USAREUR) redeployed several divisions to the Seventh Army in Germany. By the summer of 1951, V Corps had 687 tanks and VII Corps had 312.

The most substantial American armored force in occupied Germany in the late 1940s were the three US Constabulary brigades, a type of military police force. This is a M24 of the 14th Constabulary Regiment on parade in Frankfurt. These units also had M8 armored cars, and M26 medium tanks.

M26 tanks of the Tank Company, 6th Infantry Regiment, pass in review in Berlin on October 17, 1951. The regiment had been reactivated a year before by reorganizing disbanded Constabulary units.

US Tank postwar inventory 1945–50					
	31 Dec 45 total	**1949 ZI**	**1949 O/S**	**1949 total**	**1950 plan**
M22, M5A1 light tank	4,337	964	0	964	0
M24 light tank	4,962	3,379	454	3,833	3,833
M4 (75mm) medium tank	6,933	5,455	156	5,611	0
M4 (76mm) medium tank	6,582	5,635	65	5,700	3,688
M4 (105mm) howitzer tank	3,731	2,886	97	2,983	0
M26 medium tank	1,918	1,523	378	1,901	0
M45 (105mm) howitzer tank	185	183	0	183	183
M46 medium tank	0	18	0	18	810
other 90mm tank	0	49	0	49	47
flamethrower, other tanks	n/a	151	0	151	149
Total	**28,776**	**20,243**	**1,150**	**21,393**	**8,710**

ZI= Zone of the Interior; O/S = Overseas

The first significant postwar tank program was the M46 Patton that was a further development of the M26, but with a more powerful engine and better transmission. The M46 was accepted as an interim tank that could be fielded by remanufacturing the existing M26. Initial funding for the conversion was provided in the 1949 budget that covered 800 tanks, leaving 1,215 additional tanks in the inventory suitable for upgrade. The first upgraded M46 tanks were delivered in November 1949 and by the time of the outbreak of the Korean War in the summer of 1950, 319 M46 Patton tanks had been converted. There is some confusion over how many of these conversions were completed. Most surviving sources indicate 1,170 M46 tanks, but this total may include the 370 new production M46A1s. The M46 saw its combat debut in Korea; it was declared obsolete in 1957 once sufficient new tanks were available. In November 1950, the US Army dropped the previous distinction of light, medium, and heavy tanks and instead referred to them by their gun caliber; so "90mm gun tank M46A1."

The new T42 medium tank was under development at the same time, but the chassis was regarded as underpowered. The defeat of US Army units by

An M47 of the 57th Medium Tank Battalion supporting the 12th Regimental Combat Team of the 2nd Armored Division in the town of Dinkelsbühl during Exercise *Cordon Bleu* on October 13, 1955. The Aggressor forces during this period carried the green and white "Circle Trigon" insignia.

North Korean tank units at the start of the 1950 Korean War set off a tank panic in Washington. It highlighted the arthritic state of much of the tank force. The Chief of Army Field Forces complained that no existing US or British tank could "engage the most powerful Russian tanks on equal terms".

Due to the shortage of M26/M46 medium tanks at the start of the Korean War, the US Army decided to forego a completely new tank and instead to mount the new T42 90mm gun turret on new production M46 hulls, resulting in the M47 Patton tank. Since it would take some time to begin manufacturing the T42/M47 turret, new production began of the M46A1 Patton that incorporated the powertrain improvements of the M47. A total of 370 of these were completed by April 1951, the first serial-manufactured US tanks since 1945. Production at this point switched to the new M47 tank.

An M48A1 of the Tank Company, 1/14th Armored Cavalry Regiment in the village of Feuchtwangen on October 14, 1955, taking part with the Aggressor Forces during Exercise *Cordon Bleu*. This was the first large NATO exercise in which the M48A1 took part.

The initial batches of M47 tanks had so many technical flaws in the new turret that they were withheld from deployment. Production was undertaken from June 1951 to November 1953. The first M47 tanks were delivered to Seventh Army in Germany in May 1952. By the end of 1952, Seventh Army had all of its 1,640 authorized M47 tanks in place and had rebuilt 988 older M26 tanks for transfer to France, Belgium, and Italy. However, the M47 remained very troublesome in service with numerous mechanical issues.

In October 1951, NATO agreed to adopt the British Centurion and the M47 as standard. The first M47s delivered under the Mutual Security Agency program went to Belgium in June 1952. After the US Army M47s were upgraded, nearly all of these tanks were transferred to allied armies through the MDAP program. Of the 8,576 M47 manufactured, 8,552 were transferred to other armies and the type virtually disappeared from US Army service.

While M46 and M47 Patton production was taking place, development of a new 90mm tank was under way. This used the powertrain of the M47, but the hull was strongly influenced by the T43/M103 120mm gun tank design. The pilot went through tests in April 1952, and production began later that year. It was standardized as the M48 90mm gun tank in April 1953. Deficiencies in the tank, involving many of the same turret control problems as the M47, delayed widespread deployment of the M48. The M48A1 appeared shortly afterwards with the introduction of the M1 cupola, which enclosed the commander's machine gun. This was a first step in adapting to a potential nuclear battlefield, since it allowed the commander to operate the machine gun from under cover.

The M48A1 was the preferred version for US tank units in Europe and began to be deployed with USAREUR in 1955. One of the main drawbacks of the M47/M48 series was their poor fuel economy. To extend the range of the M48, tanks were fitted with a jettisonable fuel tank system at the rear, which could carry four unprotected 55gal fuel drums. A better solution was the AVI-1790-8 engine that substituted fuel injection for the previous carburetors as well as a streamlined cooling system that provided more space for internal fuel. The AVI-1790-8 was adopted in the new M48A2 in late 1955, with a production run of 2,328 tanks. Several other improvements

followed, including the new hydraulic turret control system, replacement of the previous coincidence range finder with a stereoscopic rangefinder, and a new bore evacuator for the 90mm gun. The addition of these new features led to the M48A2C and 1,344 of the previous M48A2 tanks were upgraded to this standard in 1959. The M48A2 was relatively uncommon in the US Army, since, by 1959, the production of the next-generation M60 had already begun. Of the 2,328 M48A2 tanks manufactured, 2,149 were provided to allied armies, notably to Germany, Turkey, and Korea. Officially, the M47 was named Patton 47 and the M48 was named Patton 48; however, these full names were seldom if ever used.

Following the recommendations of the Stilwell Board, led by Gen. Joseph Stilwell, the US Army also began development of a light tank to replace the M24. The main complaint about the M24 was the weakness of its gun. As a result, the focus of the new light tank program was a long 76mm gun with better antitank performance. The requirement was to be able to penetrate 5in (127mm) of armor at 30° at 1,000yds. The pilot tanks used a relatively sophisticated fire control system, but the tank panic of 1950 led to the use of a simpler configuration. The original plans were to start building a hundred tanks in 1950, but due to the Korean War, 1,000 were ordered before all of the technical issues were solved. As a result, the first 900 of the new M41 76mm gun tanks were sidelined, due to problems with their pulsing-relay turret traverse system. Cadillac redesigned the fire control system using an oil gear turret traverse system. This system was introduced into tank serial 1419 as the M41A1, and 416 of the earlier tanks were brought up to this standard. The remainder of the M41 fleet retained the pulse-relay controls once improvements had been incorporated. The M41 could successfully engage older tanks such as the T-34-85 frontally, but it had only marginal, short-range capability against contemporary tanks such as the T-54A.

Like many US tanks of this era, the M41 had poor range, only about 100 miles road range. As in the case of the M48, a fuel injection system for the engine was developed and the M41 and M41A1 were modernized as the M41A2 and M41A3 respectively. Of the 3,729 M41 tanks manufactured, 2,781 were exported through MDAP, including 445 to NATO countries. The M41 series was popular in the Asia–Pacific region and South America where the road networks could not easily support larger tanks, such as the M48.

The US Army had conducted the development of a number of heavy tank designs after 1945, none of which entered production. Due to concern over

B

1. M41A1, H&S COMPANY, 66TH TANK BATTALION, 2ND ARMORED DIVISION, EXERCISE *CORDON BLEU*, LOHR, GERMANY, OCTOBER 16, 1955

This M41A1 is finished in the usual overall FS24087 olive drab. It carries a two-digit tactical number "35" as well as a thunderbolt design that may have been peculiar to the Headquarters and Staff Company. All the markings, including the US Army star and registration number, were painted in semi-gloss white.

2. M48A1, CO. B, 32ND TANK BATTALION, 3RD ARMORED DIVISION, FRIEDBERG, GERMANY 1959

The rock star Elvis Presley was drafted into the army and served in the 3rd Armored Division in Germany as a scout. With army cooperation, he starred in a film about the US Army in Europe, released in 1960 as *G.I. Blues*. In the film he played a tank gunner, SP5 Tulsa McLean. He was shown in the film on this Patton tank. This carried the usual style of US Army tactical markings in white, with the tank tactical number 11 in white on a chrome-yellow disc.

1

2

An M41A1 tank of the 10th Reconnaissance Company, 10th Infantry Division taking part in Exercise *Polo Ball* near Würzburg, December 12, 1955. Behind it is an M75 armored personnel carrier.

the Soviet IS-3 heavy tank, a new program was initiated in 1949 with the strong backing of the US Marine Corps. It was armed with a new 120mm gun, deemed sufficient to deal with the Soviet heavy tank threat. The need for such a large and heavy vehicle came into question in 1950, due to the development of new 90mm HEAT (High Explosive Antitank) ammunition that could apparently defeat existing Soviet tank armor without recourse to the 120mm gun. In the event, the US Army only ordered 80 of the new 120mm gun tanks, while the Marines ordered 220. As was the case with many of the designs rushed into production during the tank panic, the resulting vehicles were deemed unsatisfactory and remained in depot storage until 1956, when the army standardized the design as the M103. The army deployed 72 M103 tanks with the 899th Heavy Tank Battalion in Germany in late 1957.

The Marine Corps was still not satisfied with the design and waited until a comprehensive rebuild, the M103A1, was ready in July 1959. The army subsequently requested the loan of 72 M103A1s from the marines to re-equip their sole M103 battalion in Germany, which in the meantime had been redesignated as the 2nd Heavy Tank Battalion, 33rd Armored Regiment. This loan ended in 1963 when the M103A1 tanks were returned to the marines, also ending the deployment of the M103 120mm gun tank in the US Army.

US tank production 1951–60*

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	Total
M41	675	1,222	1,222	610							**3,729**
M46A1	370										**370**
M47	972	2,745	3,107	1,752							**8,576**
M48		377	4,121	2,325	1,804	1,200	450	900	1,429	336	**12,942**
M60										420	**420**
M103			150	150							**300**
Total	**2,017**	**4,344**	**8,600**	**4,837**	**1,804**	**1,200**	**450**	**900**	**1,429**	**756**	**26,337**

**No production in 1946–50, except for pilot tanks and conversion/re-build of older tank types*

The US Army began studying the potential use of atomic weapons on the tactical battlefield in the late 1940s. The first nuclear-capable artillery, the M65 280mm gun, entered service in 1952 and the first test of its associated 15 kiloton nuclear projectile was conducted in May 1953. It took some time for the US Army to adapt to the nuclear battlefield, due to the novelty of the concept as well as the relatively small number of tactical nuclear weapons in the arsenal until the late 1950s. The Atomic Field Army-1 demonstration program began in 1954 to examine what changes would be needed in equipment and tactics. These trials eventually resulted in the development of the "Pentomic" division, organized around five battle-groups able to avoid decimation by enemy nuclear weapons by remaining dispersed and highly mobile.

An M103 tank named "Derogatory" with its turret in travel position and the gun locked to the rear at the Grafenwöhr gunnery range, September 1959. This tank belonged to the only US Army M103 unit, the 2nd Heavy Tank Battalion, 33rd Armored Regiment, 3rd Armored Division. The frame projecting from the rear of the tank was designed to carry additional fuel drums.

The advent of the Eisenhower administration and the end of the Korean War in 1953 halted the tank panic. Eisenhower was unwilling to compete with the Soviet Union in a conventional arms race, due to its inevitable drain on the economy. Instead, he adopted the "New Look" national security policy that relied on nuclear weapons to deter Soviet aggression. This included not only strategic nuclear weapons aimed at the Soviet Union, but tactical nuclear weapons aimed at the Soviet Army in Europe. Eisenhower slashed funding on conventional forces; tank production plummeted. Instead, funding was shifted to nuclear-capable tactical missiles. By the early 1960s, the US Army was spending about six times as much on missiles as on tanks and armored vehicles.

US Army tactical nuclear ballistic missile production

	1952	1953	1954	1955	1956	1957	1958	1959	1960	Total
Honest John		140	121	379	1,453	1,471	1,058	461	2,112	**7,195**
Corporal	21	129	131	132	279	158	128	108	131	**1,217**
Lacrosse						14	93	162	413	**682**
Total	**21**	**269**	**252**	**511**	**1,732**	**1,643**	**1,279**	**731**	**2,656**	**9,094**

C

AGGRESSOR FORCE ATTACK, EXERCISE *CORDON BLEU*, WÖRNITZ, GERMANY, OCTOBER 15, 1955

A pair of M48A1 tanks of Tank Company, 1st Battalion, 14th Armored Cavalry Regiment charge forward as part of the Aggressor Force during Exercise *Cordon Bleu* in Bavaria in October 1955. To simulate an atomic blast, the Trigon Army was authorized to use two different types of atomic blast demonstrators. The larger and more spectacular type was called the "Nuclear Blast Demonstrator (Locally Fabricated)," which consisted of seven 55gal drums filled with napalm and gasoline along with 200lb of TNT. When detonated, the simulator created a 180ft fireball and a 1,000ft mushroom cloud. The smaller and simpler device was the DVC 39-1 Atomic Explosion Simulator that came pre-packed as a kit. The Aggressor Forces in the 1950s had an elaborate backstory involving a fictional Trigon dictatorship with its own markings and insignia. These were covered in elaborate detail in US Army field manuals FM30-102 and FM30-103. Vehicles simulating the Trigon forces carried the "Circle Trigon" emblem, in green on a white background. The markings on these tanks are those of the 50th Tank Division of the Trigon Army, not the US Army 50th Armored Division (National Guard).

50 A 52A

The US Army in Europe remained relatively small as a result of the "New Look" doctrine. US doctrine was deliberately ambiguous. Was the US Army in Europe really expected to fight a protracted land war? Or was it merely a trigger to unleash Armageddon? Moscow could not be sure. Eisenhower was no stranger to strategic deception. The US Army's nuclear battlefield doctrine existed uneasily between wishful thinking and a belligerent bluff.

Exercise *Carte Blanche* in 1955 included 355 simulated nuclear strikes; casualties were predicted to be 1.7 million dead and 3.5 million wounded in the first week of war. It was hard to see how any army could sustain combat operations under such a situation. A 1960 assessment of the US Army's nuclear battlefield doctrine concluded that "our surveillance means, communications, mobility, and firepower are inadequate to support this doctrine and will be for some time to come … I shudder to contemplate the outcome of engagements if we continue to practice the principles and train our men exclusively on a doctrine which is based on inadequate equipment or equipment of the future." Not surprisingly, the Pentomic division and much of its associated doctrine were abandoned in the early 1960s.

A less radical aspect of Eisenhower's "New Look" policy was the need for a well-equipped alliance to defend Europe. The German Army was reborn as a key pillar of this approach. This also led to a revived tank transfer program, the Mutual Defense Assistance Program, which included new tanks such as the M41 and M47.

United Kingdom

As in the case of the United States, Britain largely demobilized its army in 1945–46. At the end of the war, the British Army possessed 5,443 light tanks, 2,823 infantry tanks and 13,667 cruiser tanks. In 1946, plans were made to retain two armored divisions and three independent armored brigades, but even this modest force structure proved to be beyond the limited postwar defense budget. The army reached its nadir in 1949. The start of the Korean War in 1950 as well as rising tensions in Europe led to some stabilization. During this period, the British Army of the Rhine (BAOR) was strengthened and included three armored divisions and one infantry division.

By 1950, the British Army had disposed of many of its wartime tanks, except for the best types such as the Comet, and began to standardize on a new generation of tanks. The Centurion tank appeared in 1945, though not in time to take part in combat. It was initially armed with the 17pdr gun, but its large size offered the potential for continual upgrade, starting in 1947 with the 20pdr (83mm) gun on the Centurion Mk. 3. Field Marshal Bernard Montgomery advocated abandonment of the prewar infantry and Cruiser tank concepts in favor of a "Universal tank." The Centurion tank largely filled this requirement and would be the backbone of the British armored regiments for nearly two decades. It also constituted almost all of British tank production in 1945–60.

The Centurion tank saw its combat debut during the Korean War. This is a Centurion Mk. 3 of Lt. M. Radford, 3 Troop Leader, 8th King's Royal Irish Hussars in 1951.

A group of Centurion Mk. 3 tanks, possibly from the Queen's Own Hussars, conduct a review for the 3rd Division commander, Maj. Gen. G.C. Gordon Lennox at Tilshead camp in 1958.

The Centurion underwent continual modernization through the 1950s. The Centurion Mk. 5 replaced the Besa co-axial machine gun with the more reliable Browning. The Centurion Mk. 7 incorporated additional internal fuel and more ready ammunition. The Mk. 8 had a thicker gun mantlet and an improved commander's cupola. Inspection of a T-54A in Budapest in 1956 by British intelligence inspired a program which was begun to increase the glacis armor of the Centurion, with an additional 2in (50mm) plate. This was introduced during Centurion Mk. 8 production as the Mk. 8/1, but was also retrofitted to the Centurion Mk. 5 as the Mk. 5/1, and to the Mk. 7 as well as the Mk. 7/1.

The thick armor of the T-54A armor revealed the need for either improved 20pdr ammunition or a more powerful gun. A 105mm gun was under development and this was introduced in 1959 on the Centurion Mk. 10.

The IS-3 threat led to the development of a new British heavy tank in the early 1950s, armed with the 120mm gun from the US M103 tank. The Conqueror program was slow in gestation, not emerging in prototype form until 1952 and not entering service until 1956. By this time, the new 105mm gun was undergoing trials. This raised questions about the need for such a large tank. As in the American case, Conqueror heavy tank production was quite modest.

The Conqueror Mk. 1 saw its public debut at a Royal Armoured Corps display at Bovington in Dorset on May 13, 1955. This is the first series production Conqueror (40 BA 75).

British tactical development followed the general patterns seen elsewhere in attempting to adapt to the nuclear battlefield. The British Army of the Rhine conducted exercises with an experimental infantry division and light armored division in 1955, based around self-contained, highly mobile groups. These experiments took place in a period of severe cuts to the defense budget. It's worth noting that total British tank production in 1945–60 was less than the combined total of Polish and Czechoslovak production.

As a result of the 1955 BAOR exercises, the armored division was reorganized in 1955–56 to make it smaller and more

mobile. Its core consisted of four armored regiments plus supporting arms. This marked a return to the tank-heavy configuration with only a single infantry battalion in the division. Starting in 1957, the divisions gradually disappeared in favor of armored brigades. These were somewhat smaller than the previous divisions, with three instead of four armored regiments.

British tank production 1945–1960

	1945/50	50/51	51/52	52/53	53/54	54/55	55/56	56/57	57/58	58/59	59/60	Total
Centurion												
Mk 1	100											100
Mk 2	250											250
Mk 3	362	229	500	573	565	359	245					2833
Mk 5							36	176	9			221
Mk 7					1	154	129	168	131	78	94	755
Mk 8							11	51	16	16	14	108
Mk 9											1	1
Mk 10											29	29
Sub-Total	*712*	*229*	*500*	*573*	*566*	*513*	*421*	*395*	*156*	*94*	*138*	*4297*
Conqueror*					6	27	17	4	38	67		159
Total	**712**	**229**	**500**	**573**	**572**	**540**	**438**	**399**	**194**	**161**	**138**	**4456**

**Does not include ~25 Caernarvon converted to Conqueror*

France

France ended the war with three armored divisions, raised and equipped with US support. The 1re Armée Française morphed into the Armée du Rhin et Danube to take over occupation duties in Germany in the late 1940s with three divisions. Many of France's wartime M4 Sherman tanks were worn-out by 1945. The US transferred a significant number of new M4A1E8 tanks to the French Army to rejuvenate the force, as well as new M24 light tanks. Britain also gave the French many surplus M4A4 Sherman V tanks. The French Army decided to standardize its remaining Sherman tanks with the Continental radial engine, rebuilding the M4A4 tanks as the M4A4T (transformé).

France attempted to rejuvenate its tank production in the wake of the war. The first effort was the "Char de Transition," which was begun in

D

CENTURION MK. 5, C SQUADRON, 4 RTR, SMUTS BARRACKS, BERLIN 1960–61

C Squadron of 4 RTR was deployed to Berlin in late 1960 to serve as the armored support of the BAOR's Berlin Independent Infantry Brigade. Traditionally, 4 RTR used tank names starting with the fourth letter of the alphabet so "Diehard" (05 BA 46), "Discoverer", and "Disdain" as seen here. The markings are fairly typical for the BAOR, so on the front is a yellow bridging weight circle, arm-of-service, vehicle registration number, and the Berlin Brigade insignia. Many of the unit tanks carried the Union Flag centrally below the registration number on the bow, although not in this case. On the rear, essentially the same markings were applied in appropriate locations. On the turret rear is C Squadron's tactical sign with "2" inside, painted on a black jerrican. On the front of the turret bins is the unit's traditional "Chinese Eye" insignia dating back to World War I when a Chinese businessman contributed money to purchase a Mark IV tank for the 4th Battalion RTR. On the sides of the turret bins are C Squadron's tactical insignia, and on the hull bin is the tank name in white on a black background. Tanks of this unit were repainted in US Army olive drab, a practice peculiar to British units stationed in Berlin. This was presumably to resemble the Allied US and French detachments in Berlin and to avoid confusion between the usual British bronze green and Soviet dark green tanks.

DISDAIN
60
02 BA 21
02 BA 21

In the decade after World War II, the French Army relied primarily on American tanks. This is a column from the 2e Division Blindée during the annual Bastille Day parade on the Champs Elysées in Paris on July 14, 1950. The three tanks in the foreground are M4A1s (76mm).

1944. The hull was derived from the Char B1 bis, but with a much larger turret and a long 75mm gun. Development work was concentrated at Atelier de Construction de Rueil (ARL), hence its designation ARL 44. In 1945, an order was placed for 500 of these tanks with delivery expected to start in September 1945. In the event, the industry was not ready for such an ambitious scheme. In December 1945, the order was reduced to 200 tanks, but the gun was increased to 90mm. In the event, only 60 were completed and in 1950 they were deployed with the 503e Régiment de Chars de Combat. The ARL 44 proved technically immature and they were retired in 1953 once the American M47 became available.

A far more successful program was initiated in 1947 to develop an air-portable light tank. This was armed with a long 75mm gun inspired by the KwK 42 on the German Panther tank. The design offered by the Atelier d'Issy

E

1. ARL 44, 503e REGIMENT DE CHARS DE COMBAT, PARIS, JULY 14, 1951

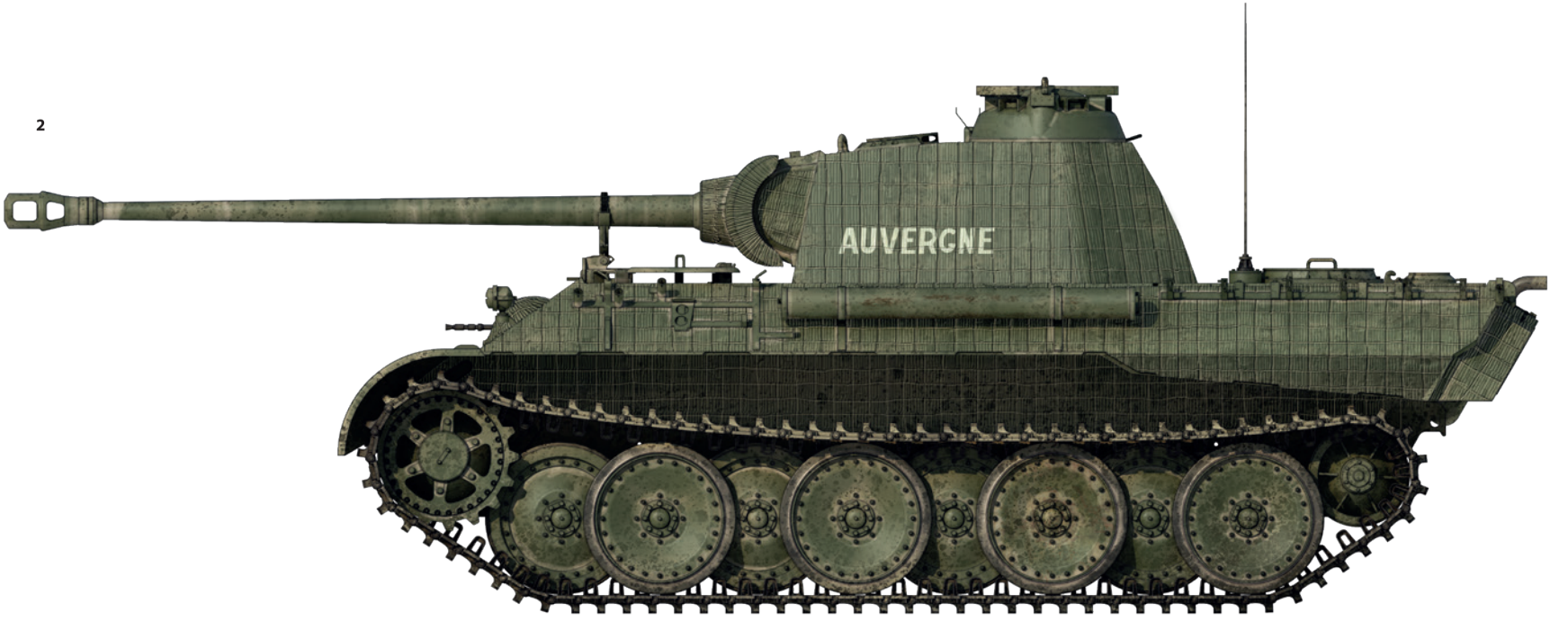
The 503e RCC received the first of the new ARL 44 tanks to replace their worn-out Panther tanks in 1951. They took part in the July 14, 1951 Bastille Day parade along the Champs-Élysées. The ARL 44s were usually named after famous battles or war heroes, in this case "G[al]DELESTRAIN" after Général Charles Delestraint, a member of the French Resistance killed by the Gestapo in 1945. His name is misspelled on the tank. In 1949, the French Army returned to the use of *vert armée* as its standard vehicle color.

2. PANTHER AUSF. A, 503e REGIMENT DE CHARS DE COMBAT, MOURMELON, FRANCE 1951

The French Army captured a number of German Panther tanks in 1944–45. At least two served with the Escadron Besnier in the siege of Saint-Nazaire in 1945. By the end of the war, 59 Panther Ausf. A and Ausf. G had been located around France, of which about 49 were made operational. They were issued to 6e Régiment de Cuirassiers and the 503e Regiment de Chars de Combat as heavy tanks, aside from a few tanks reserved for French arsenals for developmental purposes. They were difficult to keep operational due to a lack of spare parts and they were gradually retired by 1953 with the arrival of the ARL 44 and the M47 tanks. This particular tank, named "Auvergne", was stationed with the 503e RCC. It was repainted in US olive drab or French *vert armée* (army green). The French color was slightly lighter and greener than the US FS24087 olive drab.

1

2



ABOVE LEFT
The first French tank to reach serial production after the war was the ARL 44, armed with the 90mm SA 15 gun and powered by imported Maybach engines. Only 60 were built and its service career was short. This example has been preserved at the Saumur tank museum and next to it is the first successful postwar French tank, the AMX 13.

ABOVE RIGHT
The French Army received 587 M24 light tanks after the war. This is a parade of the 12e Régiment de Dragons at the Nellingen air field near Stuttgart on March 3, 1951.

les Moulineaux (AMX) was accepted for production in 1951 as the AMX 13. It was remarkably well armed for its small size, and incorporated several novel features including an oscillating turret and an autoloader. However, the French defense budget was in dire shape in the early 1950s, and under strain from the costs of the war in Indochina. After the AMX 13 was tested in the United States, the US agreed to fund the initial production program using MDAP funds. As was the case with the Centurion tank, the US also funded the production of AMX 13 tanks for NATO armies, including 131 for the Netherlands. Total production of the original 75mm version was 2,408 tanks, of which 1,735 were for the French Army and 673 for export clients. It saw its combat debut in 1956 during the Suez Crisis.

In parallel to the AMX 13, the French Army was developing a new heavy tank intended as a counter-weight to the Soviet IS-3, much like the British Conqueror and US M103. Several firms offered different designs, strongly influenced by wartime German tanks such as the Panther and Tiger II. Development eventually concentrated on the AMX 50, featuring an oscillating turret and armed with a 100mm gun. The tank underwent tests in the United States, starting in 1952, in hopes of winning American financial

The French Army was provided with M26A1 tanks in 1947 through MDAP. This column of French M26A1 tanks is seen in the French occupied zone of Germany on the Rhine river, near Rastatt, April 9, 1953.

The French Army received 856 M47 tanks in the early 1950s, its first modern medium tank. This tank named "Castelforte" is seen taking part in NATO exercises as part of the Aggressor Force in Würzburg on October 16, 1955 with the Festung Marienberg visible behind on the left bank of the Main river.

support, like that given to the AMX 13. However, the US tests concluded that the fire control system, armor construction, and overall reliability were unacceptable by US standards. The program lingered on with plans to develop a version with a more powerful 120mm gun. In the event, the program finally ended in 1959 for much the same reasons as the failure of heavy tanks in other armies of the time.

The French Army in the 1950s had to adapt to two extremes: revolutionary warfare overseas in Indochina and Algeria, and the nuclear battlefield in Europe. The legendary 2e Division Blindée was one of the first French units sent to Indochina after World War II. At peak strength in 1954, the elements of the ABC (*Arme Blindée et Cavalerie*) of the Corps expéditionnaire français en Extrême-Orient (CEFEO) had 452 tanks and tank destroyers as well as, 1,985 other armored vehicles. During the Suez Crisis in 1956, the ABC deployed 35 tanks, including AMX 13 light tanks with the 2e escadron, 2e REC and M47 tanks with the 1er escadron, 8e Régiment de Dragons. By June 1958 the French forces in Algeria had 114 AMX 13s, 355 M24 Chaffee light tanks, and 4,711 light armored vehicles.

The French response to the nuclear battlefield was the highly mobile Brigade Javelot formed in 1954 and the 7e Division Mecanique Rapide, formed in Germany in 1955. As in the case of other NATO armies, the intention was to create a division from several highly mobile modules that were agile enough to avoid concentration and nuclear annihilation.

The only French tank to be mass produced in the 1950s was the AMX 13 light tank. This is the most common production variant with some 1,694 ordered for the French Army. It was fitted with an FL 10 turret armed with a 75mm SA 50 gun.

Federal Republic of Germany

Following the destruction of the Wehrmacht in May 1945, there was no army in West Germany for nearly a decade. During the Cold War crisis of 1950–53, German politicians began to take the first tentative steps towards the creation of "a Bundeswehr strong enough to hold back the Russians but not strong enough to worry the Belgians." Not surprisingly, France was an early skeptic of this scheme, while both Britain and the United States were more favorably inclined. As France and Germany gradually reconciled, the Bundeswehr was formally created on November 12, 1955. The two main contenders for the army's tank were the M47 and Centurion; the Germans selected the M47 in June 1956, due to the estimate that the new army would eventually need 3,000 medium tanks, which the US could provide and support but Britain could not. The army's new light tank was the M41, but the light tank was not especially popular and only 50 of these were acquired.

By 1957, the Bundeswehr had two corps including two Panzer divisions, three Grenadier divisions, a mountain division, and an air-landing division. The ultimate goal was to field six Panzer and six Grenadier divisions, largely following the US Army pattern. In 1958, the Bundeswehr began to contemplate the nuclear battlefield and conducted experimental field exercises. This led to the creation of the new Division 59 organization, which switched to a modular brigade configuration. The Panzer and Panzergrenadier divisions were retained, but their component brigades were self-sufficient to fight on their own in a more mobile and dispersed fashion.

After receiving 1,120 M47 tanks, in December 1957 the Bundeswehr received the first M48A1 tanks for the 5. Panzer-Division. After receiving 233 M48A1 tanks, Germany later received 1,463 M48A2 tanks, of which 462 were the upgraded M48A2C version. Germany was the largest single user of the type.

A Bundeswehr M47 of 11. Panzer-Division crossing a Class 60 bridge near Regensburg, Germany during Exercise *Wintershield II*, February 2, 1961. This was one of the last large-scale, multinational, free-maneuvers held by the US Seventh Army in Europe, due to their complexity and cost.

F

1.M47, 2.KOMPANIE, PZ.BTL.3, 3. PANZER-DIVISION, GRAF GOLTZ-KASERNE, HAMBURG-RAHLSTADT, 1956

When delivered to the Bundeswehr, the M47 tanks were in standard US Army FS24087 olive drab. The Bundeswehr adopted its own olive drab paint, called RAL 6014 ALT Gelboliv, in 1956. This remained the standard color until the early 1980s when the somewhat greener shade RAL 6014 NEU Gelboliv was adopted. The new M47 tanks were initially marked with three-digit black tactical numbers edged in white with the first digit indicating the company, the second the platoon and the last the individual tank. This number was repeated on the rear turret bin. After a year, the traditional Maltese cross was adopted as the national insignia and painted on the turret sides in addition to the tactical number. Tanks carried standard registration numbers on the left side of the glacis plate and right upper corner of the rear engine plate. Tactical markings were often carried on the left front fender and right rear fender in white. The type shown here is derived from standard NATO map symbols.

2.M48A1, 5. PANZER-DIVISION, KOBLENZ, 1957

The 5. Panzer-Division was the first major unit to be equipped with the new M48A1 tanks. They were initially in US FS24087 olive drab and eventually they were repainted in RAL 6014 ALT Gelboliv as necessary or when major modification work was undertaken. By this time, the Bundeswehr had adopted the Maltese cross as the national insignia. A variety of tactical markings were adopted in the late 1950s to identify sub-units within the division, as shown in the inset drawing here. As in the case of the M47, the registration number was in the lower left corner of the upper glacis in front, and the upper right corner of the rear hull plate.

1

2

The Canadian Army ordered 374 Centurion Mk. 3s in 1952–53. They served in Germany with 4 Canadian Mechanized Brigade Group. This example is seen during training at CFB Gagetown. (LAC)

Other NATO armies

The tank programs of the other NATO armies are too complex to detail in this short book. The Dutch Army provides a fairly typical example. When the Dutch Army was reconstituted after the war, it had no funds for tanks. It was initially supplied with surplus Canadian Ram tanks, which had been stored in the UK. Subsequently, the UK provided 57 Sherman 17pdr Firefly tanks. Eventually, three tanks battalions were formed including 47 new M4A1 tanks and 31 M24 light tanks from US MDAP sources. By March 1951, the Dutch Army had 141 Sherman tanks on hand, though many were worn

A column of Dutch Centurion tanks supporting the 32nd Regiment during exercises near Vogelsang, West Germany, October 10, 1956. The US MDAP program funded the delivery of 592 Centurion Mk.3 tanks for the Dutch Army, though by 1956 most had been upgraded to the Mk. 5 configuration. (Nationaal Archief)

out. Due to a shortage of M47 tanks, the US funded the production of 658 Centurions for the Dutch Army, followed by a 1958 contract for 131 of the new AMX 13 (105mm FL12) to replace obsolete M24 Chafee light tanks. It's worth noting that the Dutch Army also had small tank contingents that saw combat in the overseas colonies, notably the Dutch East Indies (Indonesia).

US tank transfers in Europe*

	M24	M41	M41A1	M41A3	M4	M47	M48	M48A1	M48A2
Austria	69	42				153			
Belgium		84	110			784			
Denmark	63		53						
France	587				2,117	856			
Germany		50				1,120		233	1,463
Greece	156				67	275	673	167	
Italy	518				396	2,302			
Norway	123						38		
Netherlands	31		50		37				
Portugal	12		1		6	123			
Spain	31	38		17		489	65	66	
Turkey	238				3	980	1,948	350	404
Total	**1,828**	**214**	**214**	**17**	**2,626**	**7,082**	**2,724**	**816**	**1,867**

**Through Sep 30, 1982*

ABOVE LEFT
Norway received 123 M24 light tanks in the late 1940s. This is an M24 of the Norwegian Panserskolen on exercise in September 1949. Norway retained a small number of M24s well into the 1970s in the upgraded NM-116 version.

ABOVE RIGHT
The Italian Army received 518 M24 light tanks in the early 1950s. Here, the crew of an Italian armored cavalry M24 chat with a Canadian M8 armored car crew near Genoa during field exercises in April 1951.

Italy was the largest single operator of the M47 tank in the 1950s, receiving 2,302 examples. These tanks are seen on a training exercise in late March 1954.

TANKS IN BATTLE

Since there was never a direct conflict between NATO and the Warsaw Pact, there is little evidence of how the various tanks would compare on the battlefield. However, many of these armies used tanks in regional conflicts. The fighting varied from high-intensity conflicts, including tank-vs.-tank, through to low-intensity guerilla warfare with no tanks on the insurgent side.

The most significant conflict of this period from the perspective of tank technology was

The debut of the T-54A was during Operation *Vikhr* (*Whirlwind*), the suppression of the Hungarian revolt in Budapest in October 1956. This photo of a T-54A of the 2nd Guards Mechanized Division in Budapest was taken by one of the western military attachés.

the Korean War of 1950–53. This involved considerable tank-vs-tank fighting in the summer of 1950, at the end of which the North Korean tank force had been destroyed.[1] Tanks continued to be used in the final years of the conflict, but primarily in an infantry support role. The most important outcome of the Korean War from the tank perspective was the US tank crisis and ensuing production program of 1950–55. From a technical standpoint, tank design and modification had changed little since 1945. The tank types were primarily World War II vintage, including the M4A3E8 and M46 on the US side and T-34-85 on the North Korean side. A few new types saw their combat debut including the M46 and Centurion Mk. 3.

The Soviet Army employed tanks when suppressing popular uprisings in the satellite states, notably in East Germany in 1953 and Hungary in 1956. The Hungarian uprising saw considerably more intense combat, including some limited tank-vs-tank fighting that pitted a few Hungarian T-34-85 tanks against various Soviet types. Total tank losses during Operation *Vikhr* (*Whirlwind*) are not known, but one Russian account places it at around 100 tanks and other armored vehicles; the 33rd Guards Mechanized Division lost 12 T-34-85s, 1 IS-3, and 10 other armored vehicles. One of the most important technical outcomes of the conflict was that it gave British intelligence access to a captured T-54A tank, which significantly shaped NATO attitudes towards the need for improvements in tank firepower and armor.

France was involved in protracted conflicts in its colonies, including Indochina in 1945–54 and Algeria in the late 1950s. The French Army made extensive use of tanks in both conflicts, though there were few technological changes made to the vehicles. During the Suez Crisis of 1956, France and Britain deployed small numbers of tanks to Egypt during Operation *Musketeer* to seize control of the Suez canal. This conflict took place in conjunction with an Israeli war with the Egyptian Army in the Sinai desert.

1 For more details, see: Steven Zaloga, *T-34-85 vs M26 Pershing: Korea 1950*, Osprey Duel 32 (2011)

G

SOVIET ARMY, OPERATION *VIKHR*, HUNGARY 1956

1. T-44, 71ST TANK REGIMENT, 33RD GUARDS MECHANIZED DIVISION, BUDAPEST, NOVEMBER 1956

This tank is typical of Cold War patterns in overall camouflage green (*zashchitniiy zeleno*) an extremely dark green when new; a US match is FS 34098. Tactical markings usually included a three-digit tactical number variously called the *boevoy nomer* (combat number) or *bortovoy takticheskiy nomer* (side tactical number). The Soviet Army intentionally avoided a standardized system and encouraged variation between divisions for counter-intelligence reasons. Generally, the three numbers indicated battalion, company and individual tank, but a common alternative was to use the first number to indicate the company within a regiment, and the next two numbers sequentially as the tanks within the company. The red star marking is actually unusual on Soviet Army tanks, except for in parades.

2. T-54A, 4TH GUARDS MECHANIZED REGIMENT, 2ND GUARDS MECHANIZED DIVISION, BUDAPEST, OCTOBER 1956

This tank is in the usual camouflage green with a typical three-digit tactical number. The stenciling on the side tool box is ZIP D10-T (*Zapasnye chasti*, *instrumenti*, *i prihadlezhnosti*: spare parts, tools, and accessories) for the D10-T tank gun. The stenciling on the rear cell is "Maslo" (oil).

1

2

Centurion Mk. 5 "Bomb" of B Squadron, 6th RTR during Operation *Musketeer*, the Anglo–French intervention in Egypt during the November 1956 Suez Crisis. It is seen here in Port Said on December 22, 1956 during the UN-monitored withdrawal.

There were only a few technological lessons taken from the conflict, since most of the tank fighting in the Israeli–Egyptian War involved World War II types, including the T-34-85 and Sherman tanks. One little-appreciated outcome of the fighting was that Britain and France acquired small numbers of SU-100 tank destroyers from Egypt. Since these were armed with the same gun as the T-54A tank, it provided some insight into Soviet tank gun capabilities.

TECHNICAL ANALYSIS

The German Panther tank was the benchmark for medium tank development after World War II. Many of the tanks of the 1950s such as the Centurion, T-54, and M46, had entered development during the war when the Panther was considered the principal threat. Although most of the armies maintained the wartime categories of light, medium, and heavy tanks, a shift began in the 1950s favoring the medium tank. Heavy tanks possessed distinct weight and mobility problems, and by the end of the 1950s, medium tanks carried new types of ammunition that removed the need for the larger tank guns on the heavy tanks in the 120mm–122mm range. The emerging type was called the Universal tank in Britain, the Standard Tank (Osnovnoy tank) in the Soviet Union, and eventually the Main Battle Tank (MBT) in NATO.

NATO tanks, such as the M47 and Centurion, were close in size and weight to the Panther. The principal Soviet tank of the period, the T-54A, had armor, mobility, and firepower comparable to the Panther and newer NATO tanks, but it was significantly lighter, at 36 tonnes versus 45 tonnes. This was made possible by reducing the internal volume of the tank to only about 11.3m^3 compared to 15–17m^3 in most NATO tanks. Less internal volume meant that less armor was needed to enclose the tank, as well as permitting the use of an engine with lower horsepower. The fighting compartment of the T-54A was smaller, about 8m^3 compared to 10m^3 on the M48, but the most dramatic difference was the engine compartment, with the M48 having 7m^3 of space, more than double the 3.25m^3 of the T-54. Some compromises were needed to accomplish this, notably the decision to stow about a third of the fuel externally in lightly armored cells, and to carry about half as much main gun ammunition as the NATO tanks.

An M47 named "Chief-Wahoo", from the 57th Tank Battalion, 2nd Armored Division during Exercise *Monte Carlo*, September 1953. This was the first in-depth NATO wargame to experiment with atomic warfare and involved 120,000 US, 27,000 Belgian, 22,000 French, and 6,000 British troops.

In terms of armor protection, this generation of tanks was roughly comparable. Glacis plate armor was typically in the 100mm range, but offered the equivalent of about 200mm protection, due to the steep angle of the plate. Turret frontal armor was typically in the 150mm–200mm range, although it was difficult to summarize, since the castings varied in thickness at various points and many of the surfaces were sharply curved.

A standard production T-54B of the 1952 configuration. This variant introduced the Luna infrared night-fighting system including the L-2 searchlight to the right of the gun and the OU-3G over the commander's hatch. The TPN-1 gunner's sight replaced the MK-4 seen on the previous T-54A. This version also introduced the Tsiklon 2-axis gun stabilization system.

	T-54A	M47	M48A1	Centurion Mk. 3
Weight (tonnes, combat loaded)	36.4	48.6	52	55.9
Crew	4	5	4	4
Length (m)	9.0	8.46	8.5	9.8
Width (m)	3.27	3.5	3.6	3.6
Height (m)	2.4	2.9	2.7	2.9
Main gun caliber	100mm	90mm	90mm	84mm
Barrel length	L/54	L/48	L/48	L/70
Main gun type	D10-TG	M36	M41	OQF 20 pdr Mk 1
Ammunition	34	71	60	65
Glacis armor (mm)	100mm@60°	110mm@60°	110mm^@65°	76mm@57°
Turret front armor (mm)	200mm^	102-114mm^	145-178mm^	152mm@0°
Hull side armor (mm)	80mm@0°	76mm@0°	76mm^	51mm@-12°
Turret side armor (mm)	100-160mm^	64mm^	76mm^	112mm@10°
Engine (hp)	520	810	810	650
Fuel (liters)	530+280	880	755 (+ 835)	458
Road speed (km/h)	50	60	45	35
Road range (km)	440	130	120 (215)	100

^ *curved armor*

Gun and ammunition performance

The principal weapons of these tanks were all rifled guns in the 84mm–100mm range. The power of these weapons was heavily dependent on the ammunition rather than the caliber of the gun. During World War II, tank guns relied primarily on armor-piercing capped (APC) projectiles, or the related APCBC (APC with ballistic cap). These proved to be deficient in penetration of thick, well-sloped frontal armor, such as the Panther tank. The standard US M318 90mm APCBC round of the early 1950s could only penetrate the T-54A turret at ranges of 350m or less and could not penetrate the glacis plate at any range.

The shortcomings of the typical APC projectiles in the late 1940s led to the development of high-velocity projectiles with a sub-caliber penetrator.

This Marine M46 of Co. A, 1st Marine Tank Battalion awaits fire instructions on while supporting the Commonwealth Division during the fighting in Korea, December 15, 1952. At the time, the M46 tanks were generally earmarked for Korea while the newer M47 tanks were prioritized for the US Army in Europe. The M46 can be distinguished from the M26A1 by the rear engine deck, and especially the prominent mufflers on the mud-guards.

The most common type was the armor-piercing, composite rigid (APCR), also called high-velocity armor piercing (HVAP) by the US Army. This consisted of a sub-caliber penetrator, made of heavy, dense metal such as tungsten-carbide, encased in a lightweight aluminum shell. The penetrating power of kinetic energy projectiles such as these is more dependent on speed than projectile weight, as is evident from the traditional equation (energy = ½ mass × speed^2). The lighter weight of the APCR allowed it to travel at higher speeds than a comparable APC round, and therefore it offered superior penetration. The second type was called armor-piercing, discarding sabot (APDS) by the British and HVAPDS by the US Army. This consisted of a similar sub-caliber penetrator, but instead of being encased in a light-weight shell, the penetrator was held in place in the gun-tube by a metal sabot that separated from the projectile after leaving the gun. The first widely used APDS was developed by the British for the 17pdr and entered combat use in August 1944. Due to the higher speed of the APDS vs the APCR, it offered better penetration. However, the wartime APDS round suffered from severe dispersion problems at longer ranges, probably due to erratic separation of the sabot petals from the penetrator after leaving the barrel. So for example, the 17pdr APDS had a probability of hit of only 57 percent at 400yds compared to 91 percent for the APC round; at 1,500yds it was only 7 percent vs 24 percent. These dispersion problems were overcome in the 1950s, with the US 90mm HVAPDS, which had a 50 percent probability of hit at 2,000yds.

Other projectile configurations were well under way in the early 1950s. Three new projectiles emerged: HEAT (high-explosive antitank); HEP/HESH (high-explosive plastic/high-explosive, squash-head); and APFSDS (armor-piercing, fin-stabilized, discarding-sabot).

Of these three, HEAT was the most mature and most significant in the 1950s. HEAT ammunition was used during World War II in low-velocity antitank weapons, such as antitank rockets and howitzers. However, it was unsuitable for high-velocity tank guns until the late 1940s. A HEAT projective differed from a normal high-explosive projectile in that the high-explosive was shaped around a conical, hollow, metal liner. When the shaped-charge warhead was detonated, the explosive blast was focused on the metal liner, compressing it into a hypersonic jet of particles that could penetrate a great deal of steel armor.

There were two reasons that World War II HEAT projectiles were ineffective in high-velocity tank guns. To begin with, tank guns of the period were rifled and imparted a spin on the projectile to help improve accuracy. However, the spin substantially degraded the hypersonic jet, decreasing its penetrating power. Secondly, the impact velocity of the tank guns was so fast that the shaped-charge warhead was smashed against the enemy tank armor before the hypersonic jet could properly form. The wartime HEAT warheads employed simple mechanical impact fuzes that took around 100 microseconds to function. The technological breakthrough that made it

possible to use HEAT projectiles from high-velocity guns was the piezoelectric fuze that could initiate the shaped charge much more quickly.

The US Army began developing such a projectile for the 90mm gun and 120mm gun in February 1950. Besides the new piezoelectric fuze, the new projectile used fins at the rear to reduce spin. It was widely recognized that the existing 90mm APC and HVAP projectiles were ineffective against Soviet tanks, such as the IS-3. As a result, in 1951, the US Army authorized the use of the new T108 90mm HEAT round for the new M47 tank. The T108 offered excellent penetration, but it only had a 30 percent probability of hit at a range of 2,000yds. When British intelligence was able to inspect the T-54A tank in Budapest that had been captured by the Hungarian insurgents during the 1956 revolt, the matter became even more urgent. Curiously enough, the report slightly exaggerated the T-54's armor at 120mm at 60° when it was in fact 100mm at 54°. Regardless, the baseline threat was no longer the T-34-85, but rather the new T-54A medium tank. The T108 went through numerous iterations through the mid-1950s, with the T108E40 finally being standardized as the M348.

Viewing the T108/M348 as a stop-gap, the US Army began developing the T300 HEAT round with an aim of improving the long-range accuracy of the projectile as well as dealing with other issues such as failure to detonate when striking at extreme graze angles. This program began in February 1952, but it was not considered mature until the T300E59 arrived in 1958–59, becoming accepted for service use as the M431. This projectile was a radical redesign of the HEAT concept and formed the basis for most NATO HEAT projectiles used since. A 120mm HEAT projectile was developed for the M103 tank, which had an impressive 380mm (15in) penetration capability.

When adopted in May 1951, the US Army's M304 HVAP projectile had only marginal capabilities against the T-54A, capable of penetrating the turret at ranges up to 750m, but not able to penetrate the glacis plate. The US Army then turned to the British approach of APDS with projectiles such as the 90mm T137. A more radical approach was a long-rod penetrator. Development of this type started in 1951, but proved difficult, since its length meant that the fins were located within the propellant casing. When fired, the fins were subject to deformation by the propellent detonation. As a result, this type of kinetic energy penetrator did not emerge as a mature projectile until the early 1960s, by which time it was known as APFSDS (armor-piercing, fin-stabilized, discarding-sabot).

Another approach, favored by the British, was the HEP or HESH projectile. This type of warhead was not designed to penetrate the armor. Instead, the high-explosive warhead was allowed to squash against the target armor plate before the detonation delayed. When detonated, the high-explosive created a shock wave on the armor plate that broke off a scab of armor plate on the inside the tank armor. Although the US Army developed a HEP round for the 90mm gun, it was not a significant ammunition type in the 1950s. However, it was used on other weapons, such as recoilless rifles.

Comprehensive performance data for tank guns of this era is largely lacking, except for the US 90mm tank gun. The table below provides comparative data for a wide range of ammunition types, and so provides some sense of the relative performance of different types of ammunition in this era.

US Army 90mm tank gun ammunition data						
Standard round	M318A1	M348	M431	M304	–	–
Development designation	T33E7	T108E40	T300E59	T30E16	T137	T142E5
Type	APCBC	HEAT	HEAT	HVAP	HVAPDS	HEP
Total weight (kg)	20.4	17.6	14.7	16.8	15.0	15.3
Projectile weight (kg)	10.9	7.3	5.8	7.6	5.4	7.8
Propellant charge (kg)	3.7	3.9	3.9	3.8	3.8	3.6
Velocity (m/s)	930	855	1,220	1,020	1,250	855
Penetration (mm)						
1,000yds, 0°	157	305	340	256	350	100
1,000yds, 30°	114	261	290	197	271	100
1,000yds, 55°	84	226	252	76	101	100
1,000yds, 60°	71	152	252	64	94	100
2,000yds, 0°	150	305	340	195	282	100
2,000yds, 30°	101	261	290	151	226	100
2,000yds, 55°	71	226	252	58	94	100
2,000yds, 60°	63	152	252	49	76	100

The British Army relied primarily on the 20-pdr Mk. 3 APDS for tank fighting. This could penetrate 330mm of perpendicular armor at 1,000yds, which was exceptional performance when introduced in the late 1940s. However, this was not adequate to penetrate the T-54A glacis plate. Rather than attempt to shift to alternate forms of ammunition such as HEAT, the British Army moved toward a larger caliber gun, the 105mm L7, that entered production in 1959. This is covered in more detail in the subsequent volume in this series.

The Soviet Army was much slower to field advanced tank projectiles. The BR-412D APCBC projectile entered service in 1953 and remained the standard projectile for tank fighting into the early 1960s. The Soviet Army first deployed a HEAT round in 1957, which was developed for 76mm and 85mm guns. A HEAT round for the 100mm gun on the T-54 and T-55 entered development in 1954, but was not available until 1961. Development of 100mm APDS and APFSDS projectiles did not come to fruition until the mid-1960s. The T-54A firing the BR-412D was capable of penetrating the glacis of the M47 from 750m or less, and the turret from 950m. It was not capable of penetrating the glacis of the M48 series, but could penetrate the gun mantlet.

It is difficult to summarize the performance of the T-54A against the Centurion, due to the variations in protection during the 1950s. Glacis armor was increased with a 2in (50mm) appliqué sheet starting with the Mk. 5/1 upgrade, specifically to prevent penetration by the Soviet 100mm gun based on tests with 100mm guns captured in Egypt in 1956. The mantlet and turret underwent thickening with the Mk. 7 and later versions; the thickness of the mantlet increased from 152mm to 200mm and so was impenetrable by the BR-412B at normal ranges.

Comparative performance of medium tank guns 1950–60				
Caliber	**84mm**	**90mm**	**90mm**	**100mm**
Gun type	20 pdr	M41	M41	D-10T
Round	Mk.III	M318A1	M348	BR-412D
Type	APDS	APCBC	HEAT	APCBC
Penetration @ 30°				
1,000m (mm)	159	104	238	157
2,000m (mm)	141	92	238	132

Fire control

The combat effectiveness of tank guns is not only due to their power, but also to their accuracy and rate-of-fire. Fire control technologies in the immediate aftermath of World War II generally relied on periscopic and telescopic sights incorporating reticles that permitted the gunner to estimate the range to target. Alternately, the tank commander was sometimes provided with binoculars with stadia, and he would estimate range and provide it to the gunner. Regardless of the source of the range data, the gunner would then use the tank fire controls to incorporate appropriate super-elevation to the gun to account for range, and perhaps to incorporate some amount of lead in the case of a moving, crossing target. This system was reasonably effective at short ranges, but it became increasingly ineffective at longer ranges. For example, the M46 tank when firing APC shot had a probability of hit of 61 percent at 1,000yds but only 16 percent at 2,000yds.

The traditional solution to range-finding was optical rangefinders, and these devices had been in widespread use by antiaircraft artillery and warships for many decades. The main problem with their use on tanks was that they had to be installed under armor protection, they took up space in the turret, and they were expensive. The first mass-produced tank to employ such a device was the M47, which incorporated a T46E2 rangefinder. In contrast to the M46, the M47 gunner using his optical rangefinder had a 100 percent probability of hit at 1,000yds and 49 percent at 2,000yds. There were several drawbacks to optical rangefinders, including a high training demand and the fact that many soldiers could not use them due to eye issues. They were not well-liked by the crews, and the US Army continued to tinker with both coincidence and stereoscopic rangefinders in the M48 series. Ultimately, the US Army adopted a simpler, full-field, super-position coincidence rangefinder on the M48A3 and M60 tanks.

The Soviet Union experimented with optical rangefinders on tanks, and installed them on the SU-122-54 assault gun. However, they were rejected for use on the T-54/-55 and T-10 series due to the cost and complexity. Britain employed a coincidence rangefinder on the Conqueror tank, but not on the Centurion. The British solution to ranging was to employ a ranging machine gun in the Centurion variants fitted with the 105mm gun.

Night fighting

Germany deployed active infrared (IR) night fighting systems on a small number of armored vehicles in 1945, but the electronics were so unreliable that they were recalled. The infrared spectrum is not visible to the unaided human eye, but requires a special passive viewer to see, sometimes called a metascope. Both Britain and the United States developed infrared night driving systems during the war, but did not make extensive use of them. However, the US Army did use limited numbers of infrared sniper-scopes in the Pacific theater.

The US Army deployed searchlights on tanks in Korea in 1952, mainly to deal with massed night infantry attacks. These were 18in commercial searchlights operating in the visible light spectrum, and not infrared. It was a relatively straightforward matter to install an infrared filter over the searchlight, in association with a passive-IR viewer on the gunner's sight to use it for night fighting. Britain and the US experimented with infrared systems for tanks in the early 1950s, but avoided deploying them for many reasons. The detection range of IR systems for day use was very limited. With a typical

18in searchlight, the range was of the order of 300 meters. Furthermore, a tank painted in IR suppressing paint was not especially visible, typically until a range of about 75m. Needless to say, a tank using an IR searchlight was very visible to the opposing side if it had passive IR viewers. The muzzle blast from a tank gun would temporarily blind the gunner using IR sights, preventing adjustment of shot after the first round. In addition, the dust kicked up by muzzle blast would also blind the gunner. There were a variety of alternatives to IR tank sights, such as the use of artillery illumination rounds.

Although the NATO armies generally avoided night fighting IR systems, infrared driving aids were employed. These consisted of infrared filters placed over selected tank headlights along with a passive-IR viewer for the driver. In the US, work was under way on a next-generation system that did not require the use of a searchlight, but relied on image intensification of ambient light. These passive sights did not begin to appear until the mid-1960s.

In spite of tactical problems, the Soviet Army decided to adopt active IR tank systems in the late 1950s and in the newer generation of tanks, such as the T-55, T-10M, and PT-76B. The main Luna (moon) searchlight, mounted co-axial to the gun, was intended to provide illumination for the gunner. Many tanks also had a smaller searchlight installed on the commander's cupola. This could be used for close-range defense of the tank at night. Passive IR sights were provided to the commander, gunner, and driver.

TANK COMPARISONS

How did the various NATO and Warsaw Pact tanks compare in this period? It is difficult to make an overall assessment in such a short book, due to the sheer number of different tank types involved. Fortunately, there are at least two broad assessments from the archives that offer a tantalizing hint of the way that NATO and the Warsaw Pact viewed the technological balance.

The earliest of these two was done by the British Army Operational Research Group (AORG). The AORG based its assessment on armor of the tanks, armor penetration of the various guns, gun rate of fire, gun accuracy, and other factors. It is primarily focused on firepower and protection and not on mobility.

This assessment resulted in a comparative effectiveness number in which the British tank was evaluated against a specific Soviet tank at various ranges. An effectiveness number of "1.0" indicated that the two tanks were equally effective at that range. A number greater than 1.0 estimated the number of friendly/enemy tanks needed to make both sides equally effective in a duel. For example, in the first table below, the Comet is rated as 1.3 times as effective as the T-34-85 at 600yds. This means that it would take 13 T-34-85 tanks to be as effective as 10 Comet tanks. The 1951 study assesses engagements when firing at the center of the hull of the opposing tank; this number is listed first. It also considered aiming at the most vulnerable part of the hull. Where there is a difference in the results, the results of aiming at the vulnerable point are listed second. So the score

A T-54M on exercise. This tank was originally a T-54A rebuilt to T-54B standards with the Luna infrared system and TPN-1 sight. It is fitted with the D-10T gun tube with muzzle counter-weight instead of the D-10T2S with bore evacuator that was fitted to the standard production T-54B.

of 1.3–1.9 means a score of 1.3 when aiming at the center of the hull, and 1.9 when aiming at the most vulnerable part.

Two of these studies have been declassified, dating from 1951 and 1954. The 1954 assessment downgraded the performance of the Centurion against the Soviet tanks due to a re-assessment of the Soviet tank projectiles, probably due to weapons captured in Korea. The AORG assessment concluded that a major factor in the disparity between British and Soviet tanks was the higher rate of fire of British tanks. These assessments concluded that the Centurion Mk. 3 was significantly superior to the T-34-85 and marginally superior to the IS-3. The older Comet was regarded as generally superior to the T-34-85, but inferior to the IS-3. The Conqueror was superior to both types.

British vs Soviet tank comparative effectiveness 1951*		
	T-34-85	**IS-3**
	85mm APBC	**122mm APBC**
Comet, 17pdr APCBC		
600yds	1.3	0.9
1,000yds	1.1	0.8
1,500yds	0.9	0.8–0.9
Centurion Mk. 3, 20pdr APDS		
600yds	2.3	1.3–1.9
1,000yds	2.5	1.3–1.8
1,500yds	2.7–2.8	1.6–2.0

**AORG Report No. 11/51, August 1951*

British vs Soviet tank comparative effectiveness 1954*		
	T-34-85	**IS-3**
	85mm APBC	**122mm APCBC**
Centurion Mk. 3, 20pdr APDS		
1,000yds	1.4	1.2
2,000yds	1.7	1.4
Conqueror 120mm APDS		
1,000yds	1.3	1.4
2,000yds	1.5	1.5
Conqueror 120mm HESH		
1,000yds	1.3	1.4
2,000yds	1.1	1.2

**AORG Memo No. E.13, June 1954*

ABOVE LEFT
An M48A1 of the 37th Armored, 4th Armored Division, serving with the Aggressor forces during Exercise *Wintershield II* near Allersberg, Germany, February 3, 1951. At the rear of the tank is the external fuel rack, which could carry four 55gal fuel barrels to extend the range of the tank.

ABOVE RIGHT
The Centurion Mk. 5 switched from the co-axial Besa to the Browning machine gun. It received further glacis armor as the Mk. 5/1 and then it was upgunned and received other upgrades, finally resulting in the Mk. 11 in the early 1960s. This is a former Canadian Army Centurion Mk. 5 that was donated to the Musée des Blindées in Saumur, France in 1984 to commemorate the Canadian role in the fight for Normandy in the summer of 1944.

A far more extensive comparison was done by the Center for Operational and Strategic Research of the Soviet General Staff (TsOSI-GSVS-SSSR). These computer-based assessments were based on firepower, mobility, survivability, command and control, and other technical factors. The US Central Intelligence Agency obtained a copy of the secret August 1977 summary, which was subsequently declassified under the Freedom of Information Act. It forms the basis for the table below. A second version, released in 1991 was mainly used to fill in additional older types of tanks not included in the 1977 edition.

The Soviet assessment is similar though not identical to the British process. The Soviet assessment usually begins by choosing a particular tank as the baseline, and it is given the value of "1". Then, the other weapons are given values relative to the baseline tank. In this table, the baseline is the T-55 tank. Tanks with a score lower than 1 are regarded as inferior to the T-55; tanks with a value higher than 1 are regarded as superior.

The Soviet assessment provides a few surprises. The M47 is rated higher than either the T-55 or M48, an assessment that was not shared by the US Army. The Centurion receives relatively poor grades compared to the popular view, at least in British publications, of its relative merits to the T-55 and Patton series. This is probably due to the Soviet perception that the Centurion turret design was archaic and vulnerable. The value for the T-10M is especially high, while other Soviet assessments place it closer to 1.2 versus the T-55. Neither the M103 nor the Conqueror was included, due to the fact that both types had been retired by the time these assessments were made. This only serves to emphasize the point that older Soviet types, such as the T-34-85 and IS-2 ,were still in use in 1977.

Soviet assessment of relative combat effectiveness of NATO/Warsaw Pact tanks*	
T-34 (76mm)	0.43
PT-76	0.48
T-34-85	0.49
AMX-13 (90mm)	0.54
IS-2M	0.7
Centurion 3 (20pdr)	0.7
T-44	0.75
AMX-13 (75mm w. SS-11)	0.8
IS-3	0.83
Centurion (105mm)	0.85
T-54	0.87
T-54A	0.9
T-54B	0.9
T-55	1.0
M48/M48A1	1.0
M47	1.1
T-10M	1.51

Tsentr operativno-strategicheskikh issledovanniy Generalnogo shtaba VS-SSSR, "Resultati rascheta koeffitsientov soizmerimosti obraztsov vooruzheniya I voennoy tekhniki I voyskovikh formirovaniy SSSR i NATO, 1991

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OSPREY PUBLISHING
Bloomsbury Publishing Plc
Kemp House, Chawley Park, Cumnor Hill, Oxford OX2 9PH, UK
29 Earlsfort Terrace, Dublin 2, Ireland
1385 Broadway, 5th Floor, New York, NY 10018, USA
E-mail: info@ospreypublishing.com
www.ospreypublishing.com

OSPREY is a trademark of Osprey Publishing Ltd

First published in Great Britain in 2021
This electronic edition published in 2021 by Bloomsbury Publishing Plc

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A catalogue record for this book is available from the British Library.

ISBN: PB 9781472843296; eBook 9781472843302
ePDF 9781472843319; XML 9781472843289

Index by Fionbar Lyons
Typeset by PDQ Digital Media Solutions, Bungay, UK

Osprey Publishing supports the Woodland Trust, the UK's leading woodland conservation charity.

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ACKNOWLEDGEMENTS

All photographs in this book are from the author's collection unless otherwise stated.

AUTHOR'S NOTE

The author would like to thank Rachel Johnstone of the US Army TACOM History Office at the Detroit Arsenal for help on obtaining data on US Army tank programs.